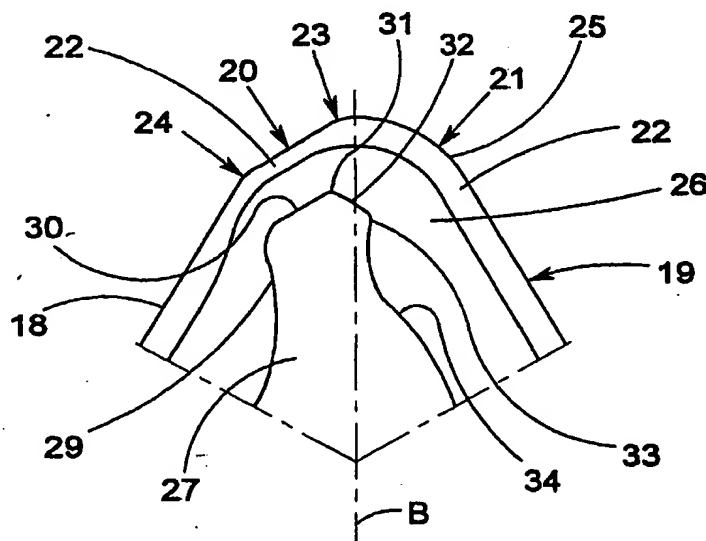


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/SE00/00262</p> <p>(22) International Filing Date: 10 February 2000 (10.02.00)</p> <p>(30) Priority Data: 9900528-2 15 February 1999 (15.02.99) SE</p> <p>(71) Applicant (for all designated States except US): SANDVIK AKTIEBOLAG [SE/SE]; S-811 81 Sandviken (SE).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): WIMAN, Jörgen [SE/SE]; Kurrasbacken 11, S-811 52 Sandviken (SE).</p> <p>(74) Agent: TÅQUIST, Lennart; Sandvik Aktiebolag, Patent Department, S-811 81 Sandviken (SE).</p>	<p>(81) Designated States: CN, JP, KR, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p><b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments. In English translation (filed in Swedish).</i></p>	

(54) Title: CUTTING INSERT FOR TURNING



## (57) Abstract

The present invention relates to an indexable insert (10) for turning having polygonal, preferably triangular basic shape including an upper surface (11), a bottom surface (12) and these interconnecting edge surfaces (13, 14, 15), at least a part of the intersecting lines between the edge surfaces and the upper surface forming at least a main cutting edge (19), a secondary cutting edge (18) and a curved corner region therebetween which is asymmetric and divided into a plurality of circular segments. The novelty of the invention is that the size of the radius of a radial edge (20) next to the secondary cutting edge shall be at least 5 times larger than the corner edge (21) located on the opposite side of the bisector and which provides a transition to the main cutting edge (19).

Cutting insert for turning

The present invention relates to an indexable insert for turning which cutting insert has a polygonal basic form including an upper surface, and a bottom surface interconnected  
5 by side surfaces, wherein at least a part of the intersection lines between the side surfaces and the upper surface forms at least one main cutting edge, a secondary cutting edge and a curved corner cutting edge therebetween.

For copy turning nowadays, to a large extent, indexable inserts are used with nose point  
10 angles below  $60^\circ$ , wherein an ordinary value on the nose point angles is  $55^\circ$ , which enables application of the cutting inserts within a broad range. On the market nowadays a number of different types of indexable inserts with  $55^\circ$  nose point angle are found, among which types rhomboidic, rhombic and regular triangular indexable inserts can be mentioned.

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In copy turning the following properties regarding feature and economy are desirable:

- 1) Good chip control, i.e. favourable chip guidance and chip breaking.
- 2) No movement of the cutting insert under impact of cutting forces.

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When copy turning inwards in certain materials or in slender work pieces and also in usage on unsteady machines and in internal metal working, low cutting forces and preferably a positive chip angle on the copying insert are also desirable. Simultaneously there is a demand in modern machines that the copy turning insert to be used will be  
25 able to give the best possible surface finish of the machined surface. Sometimes surface finish can be improved by using higher cutting speed and neutral or positive rake angles.

It is a first purpose of the invention to achieve a new and improved indexable insert for  
30 copy turning having a new type of wiper edge in the corner region which enables attainment of improved surface finish of the machined surface.

It is a second purpose to achieve an insert with a rake face in the corner area that brings about a favourable influence on the cutting force and the tool wear.

It is a third purpose to achieve an insert that is modified such that it enables increased  
5 feed whilst maintaining good surface finish.

The invention will be described in more detail in the following with reference to the enclosed drawings, wherefrom the features of the invention will become apparent.

10 Fig. 1 is a plan view of a portion of an indexable insert according to the invention.

Fig. 2 is a side view of the cutting insert in Fig. 1.

Fig. 3 is an enlarged detailed view of the corner of an insert according to Figs. 1-2.

Fig. 4 is a view showing a tool with the cutting insert of Figs. 1-3 during copy turning inwards of a work piece.

15 Fig. 5 shows a sectional view along the line V-V in Fig. 1 and

Fig. 6 is a sectional view along the line VI-VI in Fig. 1.

Figs. 1-3 show a cutting insert 10 for copying turning according to the invention with triangular basic form. The cutting insert is generally made of cemented carbide but can  
20 also be made of other ceramic materials. The insert comprises flat top and bottom surfaces 11 and 12, which are mutually parallel and which form a right angle with the edge surfaces which are designated 13, 14 and 15 and interconnected by curved corner portions. In the embodiment shown in Figs. 1-3 the edge surfaces are oriented in a plane perpendicular to the plane that includes flat surfaces 11 and 12. The insert additionally  
25 includes a plurality of cutting edges 18, 19 which, provide intersections between the edge surfaces 13, 14, 15 and the top surface 11. The insert can alternatively have positive basic shape wherein the edge surfaces intersect with the top surface at an acute angle. The insert has a central hole 16 for the receipt of a pin or a centre screw (not shown) for the clamping of the insert into a belonging tool holder 17 (Fig. 4).

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In Fig. 1 the edge surfaces extending towards an acute angled corner are designated 13 and 14, with the embodiment shown in Fig. 1 the edge 18 represents a secondary cutting

edge and the edge 19 represents a main cutting edge between which then is an asymmetric curved corner region including a radial edge 20 on one side of the bisector B intended to serve as a wiper edge and on opposite side of said bisector there is a corner edge 21 adjacent to the main cutting edge 19. It is to be understood that the insert must have such inclination that a clearance angle is obtained at the main cutting edge and at the secondary cutting edges 18, 19 and at the corner region therebetween. This will enable the edge portion 20 to be used as an edge for inwards copying such that when facing at for example 90° a large cut can be taken while the length of the edges 18 need not be specifically great. The insert is at all cutting edge portions provided with a land 22 which extends all around the insert whilst oriented substantially perpendicular towards the edge surface 13, 14, 15.

According to the invention the radial edge 20 is provided with a size of radius that is at least five times larger than the size valid for the corner edge 21 located on the opposite side of said bisector B, said corner edge being a transition to the main cutting edge 19. A further characteristic feature is that the main cutting edge 19 extends in a longitudinal direction such that it includes an angle of 80-135° together with radial edge 20.

The transition between the primary radial edge 20 and the corner edge 21 is in the form of a secondary radial edge 23, the size of which ought to be less than the radial edge 24 that represents a transition between the primary radial edge 20 and the secondary cutting edge 18. The relation should preferably be such that the size of radius of radial edge 23 is about half the size of radial edge 24 located next to the secondary edge 18. At same time a transition radial edge 25 ought to be provided between the corner edge 21 and the main cutting edge 19, the radius of which ought to be of same size as the size of the radius of radial edge 24 located next to the secondary edge 18. As regards the width of the land 22 along radial edge 20 and along the remainder of the insert it has been found suitable to select the width of said land 22 along radial edge 20 such that it amounts to 50-70 % of the width of the land 22 along the corner cutting edge 21.

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A sloping surface or downwards inclined surface 26 extends from the inner limiting edge of each land 22 and extends into a secondary sloping surface 27 which is located at

the corner area. This secondary sloping surface 27 extends into a planar central floor surface 28 of triangular basic shape whilst plane parallel with the bottom face 12 of the insert. The angle of inclination  $\alpha$  of said sloping surface 26 ought to be in the area 10-30° whereas the angle of inclination of the secondary sloping surface 27 ought to be 0-15°.

Each land 22 is planar and includes a raised land area, which in a direction away from the corner area extends into an inclined land area. A characteristic feature of the invention is that said land area 22 includes an area 22' with smaller width along the radial edge 20 which then successively appears with larger width which is uniform both along the corner cutting edge 21 as well as along the entire main cutting edge 19. At the same time as this brings about a purposeful enforcement of the cutting edge this simultaneously enables reducing the contact between the chips and the insert's surface such that the crater wear effect can be timely deferred.

In order to furthermore improve chipbreaking and deflecting the chip obtained during turning and copying a chip former is provided in the corner region. This chipformer is provided in the shape of an inclined plateau 27 that is depressed in relation to the edge portions, the confining side surfaces of which converge towards the corner with an asymmetric configuration in relation to the bisector. More specifically the shape is such that an essentially sine-formed side edge 29 located on same side of the bisector B as the primary radial edge 20 gets a termination in the form of an inclined primary edge 30 which extends parallel with radial edge 20 and then provides an obtuse angled corner 31 and then extends into a secondary edge 32 in opposite direction whereby said bisector B intersects said latter edge approximately in the middle thereof. The last mentioned secondary edge 32 provides in its turn an obtuse angled corner 33 together with the forward termination of another mainly sine-formed side edge 34 which represents a side confining edge of the plateau 27.

Thanks to the above defined radial differentiation in the corner region of the insert a surprisingly good surface smoothness of the machined surface has been achieved in comparison with a similar insert of constant corner radius, and the insert has

additionally been found less sensible to how the setting angle is provided compared with a corresponding insert with a straight wiper edge. Due to the above optimized shape of the chipformer in combination with the shape of said land 22 it has simultaneously been possible to increase the feed with 20-100 % whilst maintaining the profile depth of the generated surface.

In Fig. 4 it is shown how the illustrated embodiment of the insert is used for copying inwards with the insert clamped into a belonging toolholder 17 whereby the direction of machining is designated P on the workpiece A.

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In order to achieve optimized chip control the radii of the various radial edges should lie in the following intervals:

- 20: 5-30 mm, preferably 10-20 mm
- 15 21: 0.2-3.2 mm, preferably 0.4-1.6 mm
- 23: 0.2-1.6 mm, preferably 0.4-1.2 mm
- 24: 0.6-2.4 mm, preferably 0.8-1.6 mm
- 25: 1.6-30 mm, preferably 5-20 mm

Claims

1. An indexable cutting insert for turning having generally polygonal shape, including an upper surface (11) and a bottom surface (12) and these interconnecting edge surfaces (13, 14, 15) at least apart of the intersecting lines between the edge surfaces and the upper surface forming at least a main cutting edge (19), a secondary cutting edge (18) and a curved corner region therebetween which is asymmetric and divided into a plurality of circular segments which at the intersection line with the upper surface form edge portions wherein immediately adjacent ones of the circular segments being of mutually different radii, characterized in, that
- a) the secondary cutting edge (18) extends adjacent to a radial edge (20) which is located on same side of the bisector as the main cutting edge and appears with a radius of curvature, the size of said radius being at least 5 times larger than the corner edge (21) located on opposite side of the bisector and which provides a transition to the main cutting edge (19) and that
- b) the main cutting edge (19) mainly extends in a longitudinal direction such that it includes an angle of 80-135° together with the radial edge (20).
2. Indexable insert according to claim 1, characterized in, that the transition surface between the cutting edges (17, 18) and the top surface (11) is in the shape of a land (22) intended to reinforce the edge portions with varying width along the corner region.
3. Indexable insert according to claim 1 or 2, characterized in, that the portion of the land (22) in the corner region has such shape that the width of the land portion (22') along the secondary cutting edge (20) on one side of the bisector (B) is smaller than the width of the land (22) along the curved corner cutting edge (21) located on opposite side of the bisector (B).

4. Indexable insert according to any of the claims 1-3, characterized in, that the width of the edge reinforcing land (22) is the same along the curved corner cutting edge (21) as well as along the straight secondary cutting edge (18).
- 5 5. Indexable insert according to any of the claims 1-4, characterized in, that the width of the land (22) along the secondary cutting edge (20) constitutes 50-70 % of the width of the land along the corner cutting edge (21).
6. Indexable insert according to any of the claims 1-5, characterized in, that  
10 the insert has basic triangular form.
7. Indexable insert according to any of the claims 1-6, characterized in, that the insert in the corner region at a certain distance from the land (22) appears with a planar inclined surface (27) that is depressed in relation to the edges whilst being  
15 confined by sine-formed side confining edges (29, 34) which converge outwards towards the cutting corner.
8. Indexable insert according to claim 7, characterized in, that the sine-formed side limiting edge (29) on one side of the bisector (B) extends into a mainly  
20 straight primary edge (30) which entirely is located on one side of the bisector (B) parallel with the extension of the radial edge (20).
9. Indexable insert according to claims 7 or 8, characterized in, that the straight edge (30) extends via an obtuse angled corner (31) into another straight edge  
25 (32) which is intersected by the bisector (B).
10. Indexable insert according to claim 9, characterized in, that the bisector (B) is intersecting the straight secondary edge (32) mainly in the middle thereof.
- 30 11. Indexable insert according to any of claims 1-10, characterized in, that the sloping surface (26) inside the land (22) represents a first sloping surface which in the corner region inwardly appears next to a second sloping surface (27) wherein said



last surface slopes at a smaller angle than the first one whereby said second sloping surface (27) appears next to a planar mainly triangularly shaped flat floor surface (28).

12. Indexable insert according to claim 11, characterized in, that the sloping  
5 angle ( $\alpha$ ) is 10-30° and that the sloping angle ( $\beta$ ) is 0-15°.

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Fig. 1

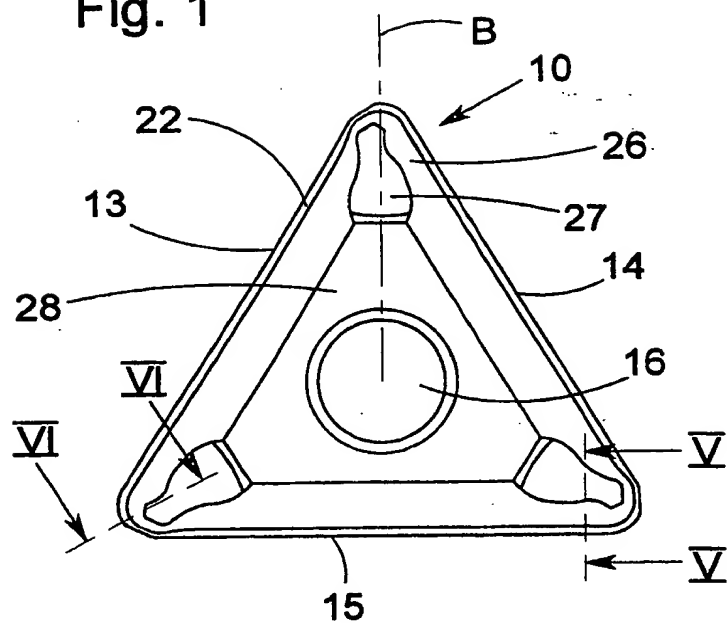


Fig. 2

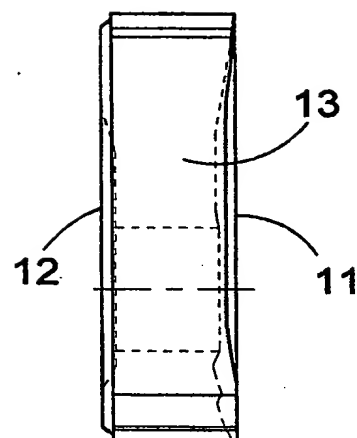
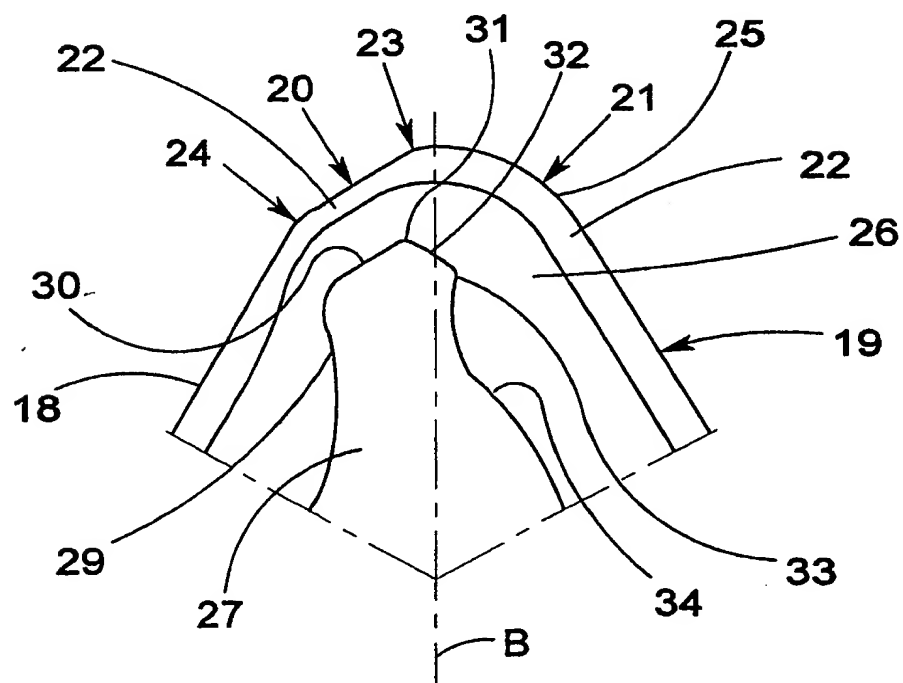


Fig. 3



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Fig. 4

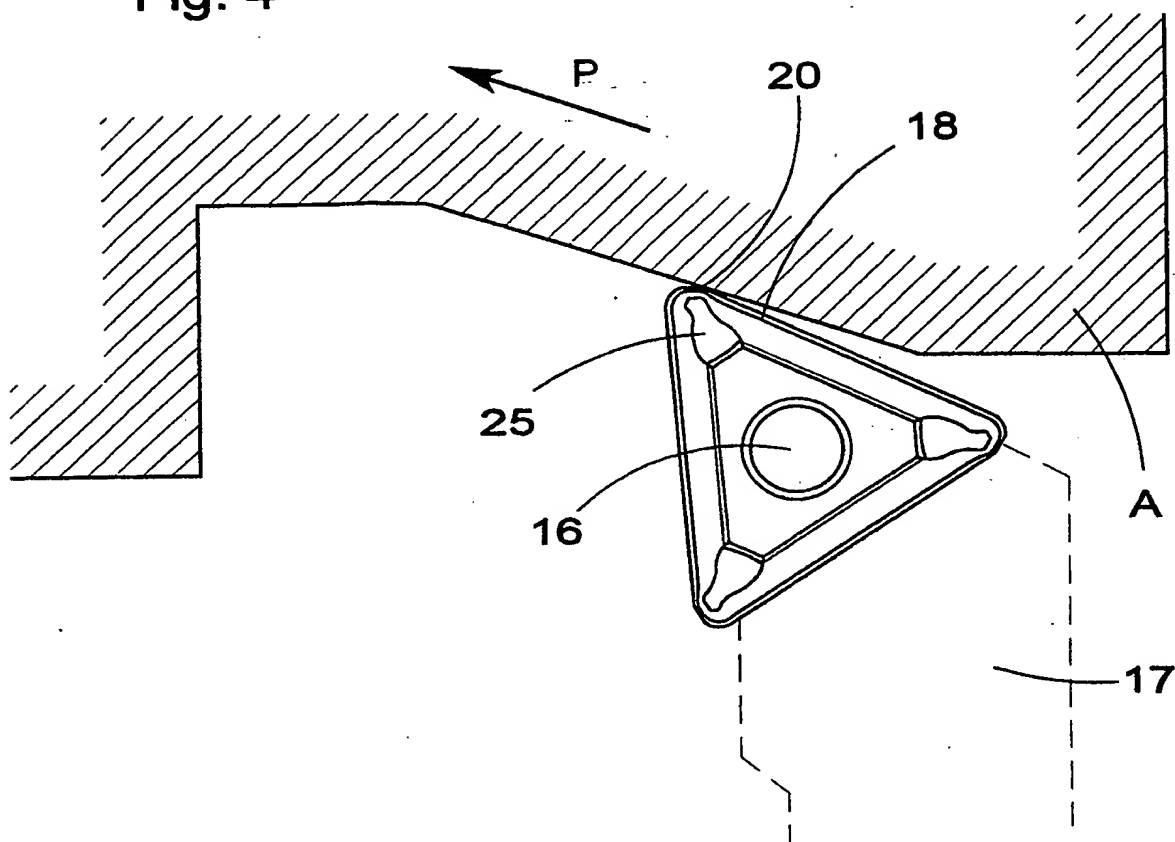


Fig. 5

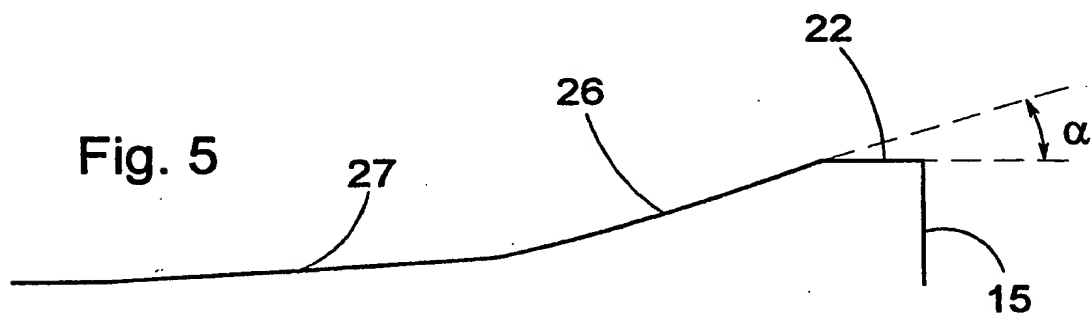
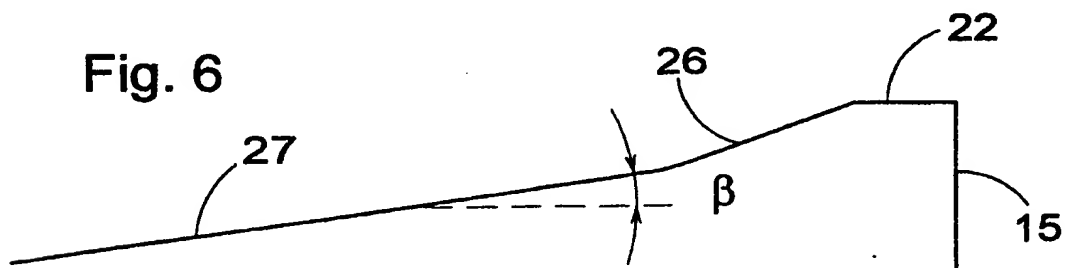


Fig. 6



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/00262

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B32B 27/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B23B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent's abstract, No 94- 5458/01, week 9401, ABSTRACT OF SU, 1782196 (KOMPLEKS RES PRODN ASSOC), 15 December 1992 (15.12.92)	1
Y	--	2,6,11-12
X	WO 9500272 A1 (KENNAMETAL INC.), 5 January 1995 (05.01.95), figure 4, abstract	1
Y	--	2,6,11-12
Y	SE 509306 C2 (SANDVIK AB), 11 January 1999 (11.01.99), figure 1, abstract	2,6
	--	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Date of the actual completion of the international search

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Date of mailing of the international search report

09-06-2000

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## INTERNATIONAL SEARCH REPORT

International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5116167 A (NIEBAUER), 26 May 1992 (26.05.92), figure 2, abstract --	2
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Information on patent family members

02/12/99

International application No.

PCT/SE 00/00262

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				WO	9214570 A	03/09/92

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

PCT/ SE 00 / 00262

International Application No.

International Filing Date

2000-02-10

The Swedish Patent Office  
PCT International Application

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference  
(if desired) (12 characters maximum)

TA 11403 DE

Box No. I TITLE OF INVENTION

Cutting insert for turning.

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the United States of America only

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| <input type="checkbox"/> <b>HU</b> Hungary                               | <input type="checkbox"/> <b>TT</b> Trinidad and Tobago                       |
| <input type="checkbox"/> <b>ID</b> Indonesia                             | <input type="checkbox"/> <b>UA</b> Ukraine                                   |
| <input type="checkbox"/> <b>IL</b> Israel                                | <input type="checkbox"/> <b>UG</b> Uganda                                    |
| <input type="checkbox"/> <b>IN</b> India                                 | <input checked="" type="checkbox"/> <b>US</b> United States of America       |
| <input type="checkbox"/> <b>IS</b> Iceland                               |  |
| <input checked="" type="checkbox"/> <b>JP</b> Japan                      | <input type="checkbox"/> <b>UZ</b> Uzbekistan                                |
| <input type="checkbox"/> <b>KE</b> Kenya                                 | <input type="checkbox"/> <b>VN</b> Viet Nam                                  |
| <input type="checkbox"/> <b>KG</b> Kyrgyzstan                            | <input type="checkbox"/> <b>YU</b> Yugoslavia                                |
| <input type="checkbox"/> <b>KP</b> Democratic People's Republic of Korea | <input type="checkbox"/> <b>ZA</b> South Africa                              |
|  | <input type="checkbox"/> <b>ZW</b> Zimbabwe                                  |

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)



10-02-2000

<b>Box No. VI PRIORITY CLAIM</b>					<input type="checkbox"/> Further priority claim indicated in the Supplemental Box.
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:			
		national application: country	regional application: regional Office	international application: receiving Office	
item (1) 15.02.99 15 Febr. 1999	9900528-2	Sweden			
item (2)					
item (3)					

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): (1)

\* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

**Box No. VII INTERNATIONAL SEARCHING AUTHORITY**

**Choice of International Searching Authority (ISA)**  
(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

ISA/SE

**Request to use results of earlier search; reference to that search** (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year)

Number

Country (or regional Office)

**Box No. VIII CHECK LIST; LANGUAGE OF FILING**

This international application contains the following number of sheets:

request : 3  
description (excluding sequence listing part) : 5  
claims : 3  
abstract : 1  
drawings : 2  
sequence listing part of description : \_\_\_\_\_

Total number of sheets : 14

This international application is accompanied by the item(s) marked below:

1. ☐ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☒ copy of general power of attorney; reference number, if any: GF 582/96
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☐ other (specify):

Figure of the drawings which should accompany the abstract:

Language of filing of the international application: Swedish

**Box No. IX SIGNATURE OF APPLICANT OR AGENT**

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Sandviken, February 10, 2000

Sandvik Aktiebolag; (publ)



Jörgen Wiman



Lennart Tåquist

For receiving Office use only		2. Drawings:  <input checked="" type="checkbox"/> received:  <input type="checkbox"/> not received:
1. Date of actual receipt of the purported international application:	2000-02-10	
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent): ISA/SE	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	

For International Bureau use only	
Date of receipt of the record copy by the International Bureau:	23 MARCH 2000 (23.03.00)

1/2

Fig. 1

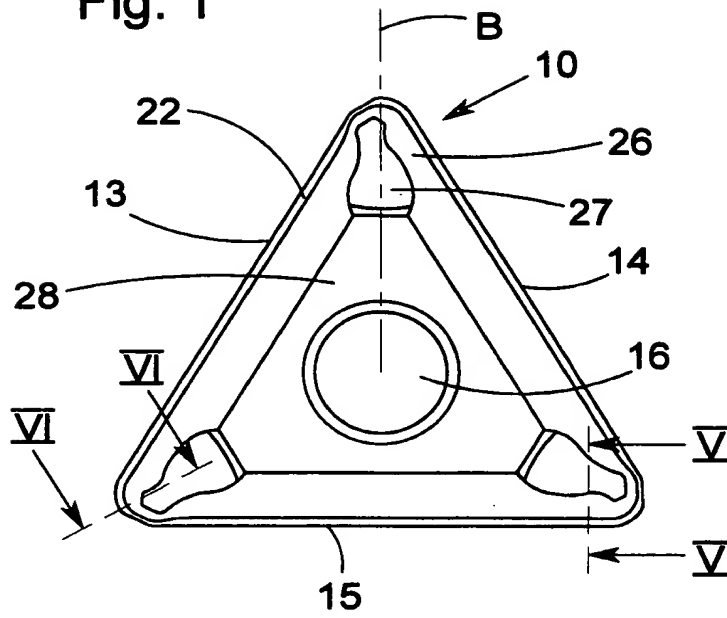


Fig. 2

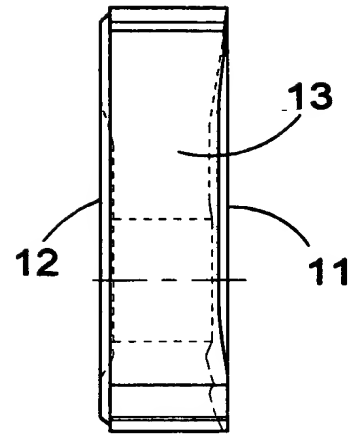
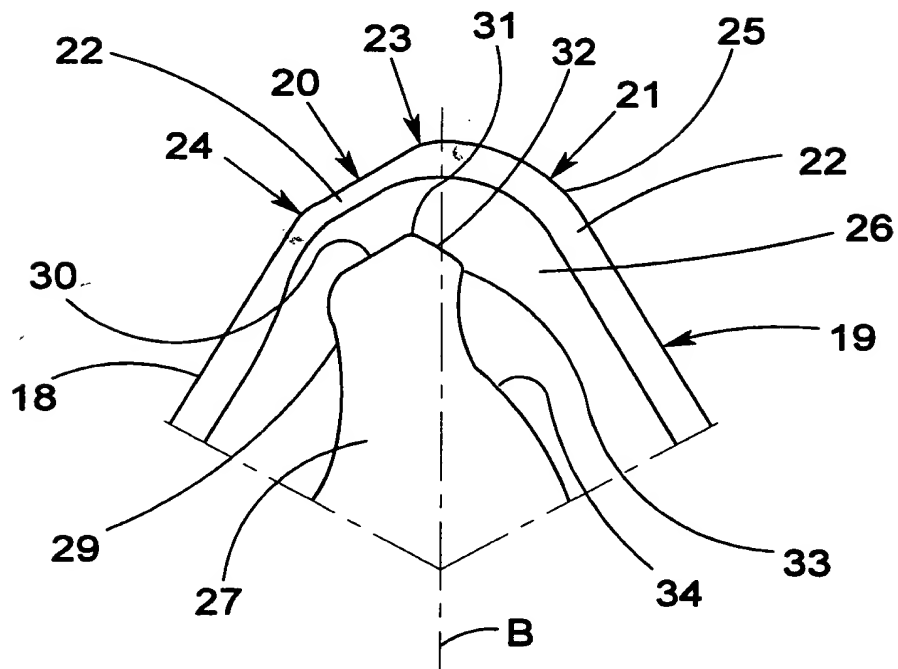


Fig. 3



2/2

Fig. 4

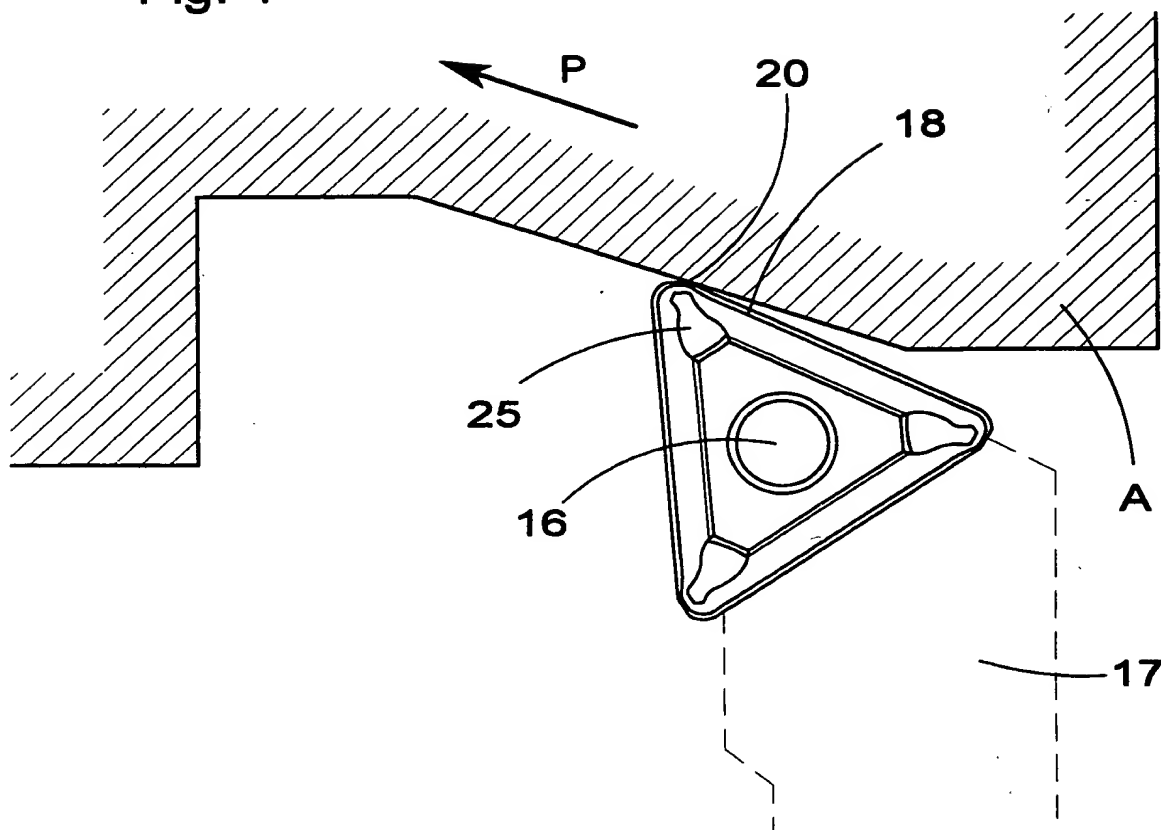


Fig. 5

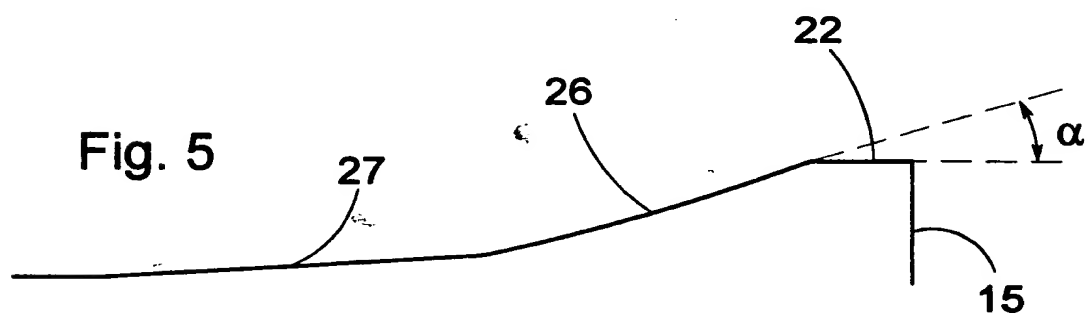
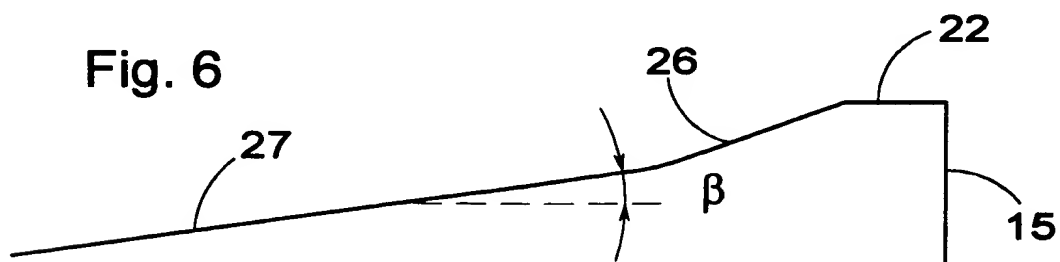


Fig. 6



Vändskär för svarvning

Föreliggande uppfinning avser ett för svarvning avsett vändskär, vilket skär har polygonal grundform innefattande en överyta, en bottenyta samt dessa förenande kanytor, varvid åtminstone en del av skärningslinjerna mellan kantytorna och överytan bildar åtminstone en huvudskäregg, en biskäregg och en däremellan krökt hörnskäregg.

För svarvning användes numera i stor utsträckning vändskär med skärspetsvinklar understigande  $60^\circ$ , varvid ett vanligt förekommande värde på spetsvinklarna, vilket möjliggör användning av skären inom ett vitt område, är  $55^\circ$ . På marknaden finns numera ett flertal olika typer av vändskär med  $55^\circ$  skärspetsvinklar, bland vilka typer kan nämnas romboidiska, rombiska och likbent triangulära vändskär.

Vid kopiersvarvning är följande egenskaper beträffande funktion och ekonomi önskvärda:

- 1) God spänkontroll, d v s gynnsam spänledning och spänbrytning.
  - 2) Ingen rörelse av skäret vid förekommande belastningsfall.
- Vid inåtgående kopiering i vissa material eller i slanka arbetsstycken, ävensom vid användning av ostadiga maskiner och vid innerbearbetning, önskas dessutom låga skärkrafter och företrädesvis positiv spänvinkel på kopierskäret. Samtidigt är kravet i moderna maskiner att det använda kopiersvarvningsskäret skall kunna ge bästa möjliga ytjämnhet hos den bearbetade ytan. Ibland kan ytfinheten förbättras genom att använda högre skärhastighet och neutrala eller positiva spänvinklar.

Ett första syfte med uppfinningen är nu att åstadkomma ett nytt och förbättrat vändskär för kopiersvarvning, vilket med en ny typ av wiper-egg-utförande i hörnregionen möjliggör uppnående av förbättrad ytfinhet hos den bearbetade ytan.

Ett andra syfte är att åstadkomma ett skär med en spånyta i hörnregionen, som blir gynnsam med avseende på skärkraften och förslitning av verktyget.

5 Ett tredje syfte är att åstadkomma ett skär som är så modifierat att det möjliggör högre matning med bibehållen god ytfinhet.

Uppfinningen skall i det följande närmare beskrivas med hänvisning till bifogade ritning, varvid ytterligare för uppfinningen kännetecknande drag kommer att framgå.

10 Fig. 1 är en planvy av ett parti av ett vändskär enligt uppfinningen.

Fig. 2 är en sidovy av skäret i fig. 1.

Fig. 3 visar en detaljförstoring av skärhörnet hos ett skär enligt fig. 1-2.

Fig. 4 visar ett verktyg bestyckat med ett skär enligt fig. 1-3 under inåtgående kopiering av ett arbetsstycke.

15 Fig. 5 visar en sektionsvy längs linjen V-V i fig. 1, och

Fig. 6 visar en sektionsvy längs linjen VI-VI i fig. 1.

Fig. 1-3 visar ett skär 10 för kopiersvarvning enligt uppfinningen med triangulär grundform. Skäret är vanligen tillverkat av hårdmetall men kan även vara tillverkat av  
20 olika keramiska material. Vändskärets flatytor 11 och 12, som är inbördes parallella, bildar rät vinkel med de dem förenande kantytorna, vilka är betecknade med 13, 14 och 15 och sinsemellan förenade med avrundade hörnpartier. Vid det i fig. 1-3 visade utförandet är kantytorna orienterade i plan vinkelrätt mot de plan som innesluter skärets flatytor 11, 12. Skäret innefattar därutöver ett flertal skäreggar 18, 19, som bildar skärets  
25 kanter i skärningen mellan kantytorna 13, 14, 15 och överytan 11. Vändskäret kan alternativt ha positivt grundutförande, där kantytorna med den övre flatytan 11 bildar spetsig vinkel. Skäret uppvisar ett centralt hål 16, avsett att mottaga lämplig tapp eller centrumskruv (ej visad) för skärets fastspänning i tillhörande skärhållare 17 (fig. 4).

30 I fig. 1 ses två mot ett spetsvinkligt hörn sammanlöpande kantytor 13 och 14. Vid det i fig. 1 visade utförandet bildar kanten 18 biskäregg och kanten 19 huvudskäregg, mellan

vilka finns en krökt asymmetrisk hörnregion innefattande en till biskäreggen 18 ansluten radieegg 20 på ena sidan bisektrisen B ägnad att tjäna såsom wiper-egg och en på motsatta sidan om bisektrisen belägen hörnskäregg 21, som ansluter till huvudeggen 19. Det är underförstått att skäret härvid måste luta på sådant sätt, att släppningsvinkel

5 finnes vid såväl huvud- liksom biskäreggarna 18, 19 liksom vid den däremellan belägna hörnregionen. Härigenom blir kantpartiet 20 användbart som inkopieringsegg så att vid exempelvis 90° inplaning en stor arbetsmån kan tagas utan att kanternas 18 längd behöver göras särskilt stora. Skäret är längs samtliga skäreggspartier utformat med ett landområde 22 som sträcker sig runt skäret och är orienterat väsentligen vinkelrätt mot

10 kantytan 13, 14, 15.

Enligt uppfinningen har radieeggen 20 utformats med en radiestorlek, som är åtminstone fem gånger större än den på motsatta sidan om bisektrisen B belägna hörnskäreggen 21, vilken bildar övergång till huvudskäreggen 19. Utmärkande är vidare, att huvud-

15 skäreggen 19 i huvudsak utsträcker sig i en längdriktning sådan att denna med radieeggen 20 innesluter en vinkel av 80-135°.

Övergången mellan den primära radieeggen 20 och hörnskäreggen 21 är i form av en sekundär radieegg 23, som till storleken bör vara mindre än den radieegg 24 som bildar

20 övergång mellan den primära radieeggen 20 och biskäreggen 18. Företrädesvis bör relationen vara sådan att radieeggen 23 har cirka hälften så stor radiestorlek som den närmast bieggarna 18 belägna radieeggen 24. Samtidigt bör en övergångsradieegg 25 vara utbildad mellan hörneggen 21 och huvudskäreggen 19, vars radiestorlek företrädesvis bör vara av samma storlek som radiestorleken hos den närmast bieggarna 18 belägna

25 radieeggen 24. Beträffande bredden av landområdet 22 längs radieeggen 20 respektive längs skäret i övrigt har det befunnits lämpligt att låta bredden av landområdet 22 längs radieeggen 20 uppgå till 50-70 % av bredden av landområdet 22 längs hörnskäreggen 21.

30 En sluttningsyta eller nedåt lutande yta 26 sträcker sig från den inre begränsningskanten hos varje land 22 och övergår i en sekundär lutande yta 27, som är lokaliserad till

hörnregionen. Denna sekundära lutande yta 27 övergår i en plan golvyta 28 centralt belägen med triangulär grundform och samtidigt planparallell med skärets bottenyta 12. Lutningsvinkeln  $\alpha$  hos den lutande ytan 26 bör ligga i området 10-30°, medan lutningsvinkeln för den sekundära lutande ytan 27 bör uppgå till 0-15°.

5

Varje land 22 är plant och innefattar ett förhöjt landområde som i riktning bort från skärhörnet övergår i ett snett nedåt lutande landområde. Ett för föreliggande uppfinning utmärkande särdrag är att detta landområde 22 innefattar ett område 22' med mindre bredd längs radieeggen 20 för att sedan successivt övergå till en större bredd, som är

10 enhetlig längs såväl hörnskäreggen 21 liksom längs hela huvudskäreggen 19. Samtidigt som det med detta utförande uppnås en ändamålsenlig förstärkning av skäreggen blir det samtidigt möjligt att kunna reducera kontakten mellan spånorna och skärytan så att gropförslitningseffekten senareläggs.

- 15 I syfte att ytterligare förbättra spånbrytning och avledning av den vid svarvning och kopiering erhållna spånan har en spånformare utbildats i hörnregionen. Denna spånformare har utbildats såsom en relativt eggpartierna försänkt snett lutande plåt 27, vars sidobegränsningsytor konvergerar ut mot hörnet med relativt bisektrisen asymmetrisk konfiguration. Närmare angivet är formen sådan, att en väsentligen
- 20 sinusformad sidokant 29 hos spånformaren på samma sida om bisektrisen B som den primära radieeggen 20 får en avslutning i form av en primär sned kant 30, som utsträcker parallellt med radieeggen 20 varefter denna bildar trubbvinkligt hörn 31 med en i motsatt riktning sned sekundär kant 32, varvid bisektrisen B genomskär sistnämnda 32 i huvudsak på mitten därav. Den sistnämnda sekundära kanten 32 bildar i sin tur ett
- 25 trubbvinkligt hörn 33 med den främre ändavslutningen med en annan väsentligen sinusformad sidokant 34, som utgör sidobegränsningskant hos plåtan 27.

- Genom den ovan angivna radiedifferentieringen hos hörnregionen av skäret har en överraskande god ytfinhet hos den genererade ytan kunnat uppnås i jämförelse med ett
- 30 likadant skär fast med konstant hörnradie, varjämte skäret blivit mindre känsligt vid inställningen av ställvinkeln jämfört med ett motsvarande skär med rak wiper-egg. På

grund av den enligt ovan optimerade utformningen av spånformaren i kombination med landets 22 utförande har det samtidigt befunnits möjligt att öka matningen med 20-100 % med bibehållet profildjup hos den genererade ytan.

- 5 I fig. 4 är visat huruvida den visade utföringsformen av skäret används för inkopiering, fastspänt i sin tillhörande skärhållare 17, varvid bearbetningsriktningen är utmärkt med P på arbetsstycket A.

- I syfte att uppnå optimal spånkontroll bör de olika radieeggarnas radier ligga inom  
10 följande intervall:

- 20: 5-30 mm, företrädesvis 10-20 mm
- 21: 0,2-3,2 mm, företrädesvis 0,4-1,6 mm
- 23: 0,2-1,6 mm, företrädesvis 0,4-1,2 mm
- 15 24: 0,6-2,4 mm, företrädesvis 0,8-1,6 mm
- 25: 1,6-30 mm, företrädesvis 5-20 mm



Patentkrav

1. För svarvning avsett vändskär (10) vilket har polygonal grundform innefattande en överyta (11) en bottenyta (12) samt dessa förenande kantytor (13, 14, 15) varvid  
5 åtminstone en del av skärningslinjerna mellan kantytorna och överytan bildar åtminstone en huvudskäregg (19), en biskäregg (18) och en däremellan belägen krökt hörnregion som är asymmetrisk och uppdelad i ett flertal cirkelsegment, som vid skärningslinjen med överytan bildar eggpartier där intilliggande cirkelsegment uppvisar olika radier,  
k ä n n e t e c k n a t av, i kombination, att  
10 a) till bieggan (18) ansluter en radieegg (20), som är utformad på samma sida om bisektrisen som huvudeggan samt uppvisar en krökningsradie, vars radiestorlek är åtminstone 5 ggr större än den på motsatta sidan av bisektrisen belägna hörnskaegg (21) som bildar övergång till huvudskäreggan (19) och att  
15 b) huvudskäreggan (19) i huvudsak utsträcker i en längdriktning sådan att den med radieeggen (20) innesluter en vinkel av 80-135°.
2. Vändskär enligt krav 1, k ä n n e t e c k n a t av, att övergångsytan mellan  
20 skäreggarna (17, 18) och överytan (11) har formen av ett land (22), ägnat att förstärka eggpartierna med längs hörnregionen varierande bredd.
3. Vändskär enligt krav 1 eller 2, k ä n n e t e c k n a t därav, att den i hörnregionen belägna delen av landet (22) har sådan utformning att bredden av landpartiet (22') längs  
25 biskäreggan (20) på ena sidan om bisektrisen (B) är mindre än bredden av landet (22) längs den krökta hörnskaegg (21), belägen på motsatta sidan om bisektrisen (B).
4. Vändskär enligt något av kraven 1-3, k ä n n e t e c k n a t därav, att bredden av det eggförstärkande landet (22) är densamma längs såväl den krökta hörnskaegg (21)  
30 liksom längs den raka biskäreggan (18).

5. Vänskär enligt något av kraven 1-4, k ä n n e t e c k n a t därav, att bredden av landet (22) längs biskäreggen (20) utgör 50-70 % av bredden hos det längs hörnskäreggen (21) belägna landet.
- 5 6. Vänskär enligt något av kraven 1-5, k ä n n e t e c k n a t därav, att skäret har triangulär grundform.
7. Vänskär enligt något av kraven 1-6, k ä n n e t e c k n a t därav, att skäret i hörnregionen på visst avstånd från landet (22), uppvisar en relativt eggarna försänkt plan
- 10 lutande yta (27) med ut mot skärhörnet konvergerande väsentligen sinusformade sidobegränsningskanter (29, 34).
8. Vänskär enligt krav 7, k ä n n e t e c k n a t därav, att den sinusformade begränsningskanten (29) på ena sidan bisektrisen (B) övergår i en väsentligen rak primär
- 15 kant (30) som i sin helhet är belägen på ena sidan om bisektrisen (B) i parallellitet med utsträckningen av radieeggen (20).
9. Vänskär enligt krav 7 eller 8, k ä n n e t e c k n a t därav, att den raka kanten (30) via ett trubbvinkligt hörn (31) övergår i en annan rak sekundär kant (32), vilken
- 20 genomskäres av bisektrisen (B).
10. Vänskär enligt krav 9, k ä n n e t e c k n a t därav, att bisektrisen (B) genomskär den raka sekundära kanten (32) i huvudsak mitt på densamma.
- 25 11. Vänskär enligt något av kraven 1-10, k ä n n e t e c k n a t därav, att den innanför landet (22) snett lutande ytan (26) utgör en första lutande yta, vilken i hörnregionen gränsar inåt till en andra lutande yta (27), varvid sistnämnda yta lutar under mindre vinkel än den förstnämnda, varvid den nämnda andra lutande ytan (27) gränsar mot en plan väsentligen triangulärt formad plan golvyta (28).

12. Vändskär enligt krav 11, k ä n n e t e c k n a t därav, att lutningsvinkeln ( $\alpha$ ) hos ytan (26) är 10-30°, och att lutningsvinkeln ( $\beta$ ) hos ytan (27) är 0-15°.

Sammandrag

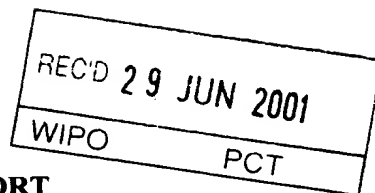
Uppfinningen avser ett för svarvning avsett vändskär (10) vilket har polygonal, företrädesvis triangulär grundform innefattande en överyta (11), en bottenyta (12) samt  
5 dessa förenande kantytor (13, 14, 15) varvid åtminstone en del av skärningslinjerna mellan kantytorna och överytan bildar åtminstone en huvudskäregg (19), en biskäregg (18) och en däremellan belägen krökt hörnregion, som är asymmetrisk och uppdelad i ett flertal cirkelsegment. Nyheten hos uppfinningen är att radiestorleken hos en till bieggan anslutande radieegg (20) ska vara åtminstone 5 ggr större än den på motsatta sidan av  
10 bisektrisen belägna hörnskäreggen (21) som bildar övergång till huvudskäreggen (19).

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference TA 11403 DE	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/SE00/00262	International filing date (day/month/year) 10.02.2000	Priority date (day/month/year) 15.02.1999
International Patent Classification (IPC) or national classification and IPC <sup>7</sup> B23B 27/16		
Applicant Sandvik Aktiebolag et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  30.08.2000	Date of completion of this report  18.06.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer  Eddy Leopold/MP Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/Se00/00262

## I. Basis of the report

1. With regard to the **elements** of the international application:\*☐ the international application as originally filed☒ the description:pages 1-5, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

☒ the claims:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, as amended (together with any statement) under article 19

pages \_\_\_\_\_, filed with the demand

pages 6-7, filed with the letter of 26.03.2001☒ the drawings:pages 1-2, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

☐ the sequence listing part of the description:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.These elements were available or furnished to this Authority in the following language English which is:☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).☒ the language of publication of the international application (under Rule 48.3(b)).☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:☐ contained in the international application in written form.☐ filed together with the international application in computer readable form.☐ furnished subsequently to this Authority in written form.☐ furnished subsequently to this Authority in computer readable form.☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.4. ☐ The amendments have resulted in the cancellation of:☐ the description, pages \_\_\_\_\_☐ the claims, Nos. \_\_\_\_\_☐ the drawings, sheet/fig \_\_\_\_\_5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE00/00262

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	<u>1-7</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-7</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-7</u>	YES
	Claims		NO

**2. Citations and explanations (Rule 70.7)**

New claims 1-7 are submitted 2001-03-26.

The invention relates to an indexable cutting insert for turning. Parts of the intersecting lines between the edge surface and the upper surface, forming a main cutting edge, a secondary cutting edge and a curved corner region therebetween.

The object of the invention is to improve the surface finish of the machined surface, and bring a favourable influence on the cutting force and the tool wear.

This is made possible, in that the transition surface between the cutting edges 17 and 18 and the top surface 11 is in shape of an edge reinforcing land area in the way mentioned in claim 1.

None of the documents cited in the international search report or any combinations of them, shows an indexable cutting insert as mentioned in claim 1.

Therefore, the subject matter of the invention is new, is considered to involve an inventive step, and has industrial applicability.

Claims

1. An indexable cutting insert for turning having generally polygonal shape, including an upper surface (11) and a bottom surface (12) and these interconnecting edge surfaces (13, 14, 15) at least apart of the intersecting lines between the edge surfaces and the upper surface forming at least a main cutting edge (19), a secondary cutting edge (18) and a curved corner region therebetween which is asymmetric and divided into a plurality of circular segments which at the intersection line with the upper surface form edge portions wherein immediately adjacent ones of the circular segments being of mutually different radii, a secondary cutting edge (18) extends adjacent to a radial edge (20) which is located on same side of the bisector as the main cutting edge and appears with a radius of curvature, the size of said radius being at least 5 times larger than the corner edge (21) located on opposite side of the bisector and which provides a transition to the main cutting edge (19), characterized in, that
- 15 a) the insert is in the shape of a regular polygon-shaped body,
- b) that the transition surface between the cutting edges (17, 18) and the top surface (11) is in the shape of an edge reinforcing land (22) of such shape that the width of the land portion (22') along the secondary cutting edge (20) on one side of the bisector (B) is
- 20 smaller than the width of the land (22) along the curved corner cutting edge (21) located on opposite side of the bisector (B).
2. Indexable insert according to claim 1, characterized in, that the width of
- 25 the edge reinforcing land (22) is the same along the curved corner cutting edge (21) as well as along the straight secondary cutting edge (18).
3. Indexable insert according to any of the claims 1-2, characterized in, that
- 30 the width of the land (22) along the secondary cutting edge (20) constitutes 50-70 % of the width of the land along the corner cutting edge (21).



4. Indexable insert according to any of the claims 1-3, characterized in, that the insert in the corner region at a certain distance from the land (22) appears with a planar inclined surface (27) that is depressed in relation to the edges whilst being confined by sine-formed side confining edges (29, 34) which converge outwards
- 5 towards the cutting corner.
5. Indexable insert according to claim 4, characterized in, that the sine-formed side limiting edge (29) on one side of the bisector (B) extends into a mainly straight primary edge (30) which entirely is located on one side of the bisector (B)
- 10 parallel with the extension of the radial edge (20).
6. Indexable insert according to claims 4 or 5, characterized in, that the straight edge (30) extends via an obtuse angled corner (31) into another straight edge (32) which is intersected by the bisector (B).
- 15
7. Indexable insert according to claim 6, characterized in, that the bisector (B) is intersecting the straight secondary edge (32) mainly in the middle thereof.

## PCT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
United States Patent and Trademark  
Office  
Box PCT  
Washington, D.C. 20231  
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

<b>Date of mailing (day/month/year)</b> 04 October 2000 (04.10.00)	<b>Applicant's or agent's file reference</b> TA 11403 DE
<b>International application No.</b> PCT/SE00/00262	<b>Priority date (day/month/year)</b> 15 February 1999 (15.02.99)
<b>International filing date (day/month/year)</b> 10 February 2000 (10.02.00)	
<b>Applicant</b> WIMAN, Jörgen	

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

30 August 2000 (30.08.00)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<b>The International Bureau of WIPO</b> 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	<b>Authorized officer</b> Claudio Borton Telephone No.: (41-22) 338.83.38
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## CUTTING INSERT FOR TURNING

### Background of the Invention

**0001]** The present invention relates to an indexable insert for turning which cutting insert has a polygonal basic form including an upper surface, and a bottom surface. The top and bottom surfaces are interconnected by side surfaces, wherein at least a part of the intersection lines between the side surfaces and the upper surface forms at least one main cutting edge, a secondary cutting edge and a curved corner cutting edge therebetween.

**0002]** For copy turning nowadays, to a large extent, indexable inserts are used with nose point angles below  $60^\circ$ , wherein an ordinary value of the nose point angles is  $55^\circ$ , which enables application of the cutting inserts within a broad range. On the market nowadays a number of different types of indexable inserts with  $55^\circ$  nose point angle are found, among which types rhomboidic, rhombic and regular triangular indexable inserts can be mentioned.

**0003]** In copy turning the following properties regarding feature and economy are desirable:

**0004]** 1) Good chip control, i.e. favourable chip guidance and chip breaking.

**0005]** 2) No movement of the cutting insert under impact of cutting forces.

**0006]** When copy turning inwards in certain materials or in slender work pieces and also in usage on unsteady machines and in internal metal working, low cutting forces and preferably a positive chip angle on the copying insert are also desirable. Simultaneously there is a demand in modern machines that the copy turning insert to be used will be able to give the best possible surface finish of the machined surface. Sometimes the

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surface finish can be improved by using higher cutting speed and neutral or positive rake angles.

#### Objects and Summary of the Invention

**0007]** It is a first purpose of the invention to achieve a new and improved indexable insert for copy turning having a new type of wiper edge in the corner region which enables attainment of improved surface finish of the machined surface.

**0008]** It is a second purpose to achieve an insert with a rake face in the corner area that brings about a favourable influence on the cutting force and the tool wear.

**0009]** It is a third purpose to achieve an insert that is modified such that it enables increased feed whilst maintaining good surface finish.

**0010]** The present invention relates to an indexable cutting insert having a polygonal shape and including an upper surface, a lower surface, and an edge surface structure interconnecting the upper and lower surfaces. An intersection between the edge surface structure and the top surface forms: a main cutting edge, a secondary cutting edge, and a curved corner region disposed between the main and secondary cutting edges. The corner region includes a radial edge and a corner edge of mutually different radii of curvature. The radial edge and the secondary cutting edge are disposed on a first side of a bisector of the corner region. The corner edge and the main cutting edge are located on a second side of the bisector. A radius of curvature of the radial edge is at least five times larger than a radius of curvature of the curved edge. The top surface includes an edge-reinforcing land extending along the radial edge and the curved edge. A portion of the land extending along the radial edge being of smaller width than a portion of the land extending along the curved edge.

Brief Description of the Drawings

**0011]** The invention will be described in more detail in the following with reference to the enclosed drawings, wherefrom the features of the invention will become apparent.

**0012]** Fig. 1 is a plan view of a portion of an indexable insert according to the invention.

**0013]** Fig. 2 is a side view of the cutting insert in Fig. 1.

**0014]** Fig. 3 is an enlarged detailed view of the corner of an insert according to Figs. 1-2.

**0015]** Fig. 4 is a view showing a tool with the cutting insert of Figs. 1-3 during copy turning inwards of a work piece.

**0016]** Fig. 5 shows a sectional view along the line V-V in Fig. 1 and

**0017]** Fig. 6 is a sectional view along the line VI-VI in Fig. 1.

Detailed Description of Preferred Embodiment of the Invention

**0018]** Figs. 1-3 show a cutting insert 10 for copying turning according to the invention with triangular basic form. The cutting insert is generally made of cemented carbide but can also be made of other ceramic materials. The insert comprises flat top and bottom surfaces 11 and 12, which are mutually parallel and which form a right angle with the edge surfaces which are designated 13, 14 and 15 and interconnected by curved corner portions. In the embodiment shown in Figs. 1-3 each of the edge surfaces is oriented in a plane perpendicular to the planes that include the flat surfaces 11 and 12. The insert additionally includes a plurality of cutting edges 18, 19 which provide intersections between the edge surfaces 13, 14, 15 and the top surface 11. The insert can alternatively have positive basic shape wherein

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the edge surfaces intersect with the top surface at an acute angle. The insert has a central hole 16 for the receipt of a pin or a centre screw (not shown) for the clamping of the insert into a belonging tool holder 17 (Fig. 4).

**0019]** In Fig. 3 the edge 18 represents a secondary cutting edge and the edge 19 represents a main cutting edge between which there is an asymmetric curved corner region including a radial edge 20 on one side of the bisector B intended to serve as a wiper edge and on opposite side of said bisector there is a corner edge 21 adjacent to the main cutting edge 19. It is to be understood that the insert must have such inclination that a clearance angle is obtained at the main and secondary cutting edges 18, 19 and at the corner region therebetween. This will enable the edge portion 20 to be used as an edge for inwards copying such that when facing at for example  $90^\circ$  a large cut can be taken while the length of the edges 18 need not be specifically great. The insert is provided at all cutting edge portions with a land 22 which extends all around the insert whilst oriented substantially perpendicular towards the edge surface 13, 14, 15.

**0020]** According to the invention the radial edge 20 is provided with a radius that is at least five times larger than the size valid for the corner edge 21 located on the opposite side of said bisector B, said corner edge being a transition to the main cutting edge 19. A further characteristic feature is that the main cutting edge 19 extends in a longitudinal direction such that it includes an angle of  $80-135^\circ$  together with radial edge 20.

**0021]** The transition between the primary radial edge 20 and the corner edge 21 is in the form of a secondary radial edge 23, the size of which ought to have a radius less than that of the radial edge 24 that represents a transition between the primary radial edge 20 and the secondary cutting edge 18. The relation should preferably be such that the size of the radius

of radial edge 23 is about half the size of the radius of radial edge 24 located next to the secondary edge 18. At the same time, a transition radial edge 25 ought to be provided between the corner edge 21 and the main cutting edge 19, the radius of which ought to be of same size as the size of the radius of radial edge 24 located next to the secondary edge 18. As regards the width of the land 22 along radial edge 20 and along the remainder of the insert, it has been found suitable to select the width of the portion of said land 22 that extends along radial edge 20 such that it amounts to 50-70 % of the width of the portion of the land 22 that extends along the corner cutting edge 21.

**0022]** A sloping surface or downwards inclined surface 26 extends from the inner limiting edge of each land 22 and extends into a secondary sloping surface 27 which is located at the corner area. This secondary sloping surface 27 extends into a planar central floor surface 28 of triangular basic shape while oriented plane parallel with the bottom face 12 of the insert. The angle of inclination  $\alpha$  of said sloping surface 26 ought to be in the range of  $10-30^\circ$  whereas the angle of inclination of the secondary sloping surface 27 ought to be  $0-15^\circ$ .

**0023]** Each land 22 is planar and includes a raised land area, which in a direction away from the corner area extends into an inclined land area. A characteristic feature of the invention is that said land area 22 includes an area 22' with smaller width along the radial edge 20 which then successively appears with larger width which is uniform both along the corner cutting edge 21 as well as along the entire main cutting edge 19. At the same time as this brings about a purposeful enforcement of the cutting edge, this simultaneously enables reducing the contact between the chips and the insert's surface such that the crater wear effect can be timely deferred.

**0024]** In order to furthermore improve chipbreaking and deflection of the chip obtained during turning and copying, a chip former is provided in the corner region. This chipformer is provided in the shape of an inclined plateau 27 that is depressed in relation to the edge portions, the confining side surfaces of which converge towards the corner with an asymmetric configuration in relation to the bisector. More specifically the shape is such that an essentially sine wave-shaped side edge 29 located on same side of the bisector B as the primary radial edge 20 gets a termination in the form of an inclined primary edge 30. That edge 30 extends parallel with the radial edge 20 and then provides an obtuse angled corner 31 and then extends into a secondary edge 32 in the opposite direction whereby said bisector B intersects said latter edge approximately in the middle thereof. The last mentioned secondary edge 32 provides in its turn an obtuse angled corner 33 together with the forward termination of another mainly sine wave-shaped side edge 34 which represents a side confining edge of the plateau 27.

**0025]** Thanks to the above defined radial differentiation in the corner region of the insert a surprisingly good surface smoothness of the machined surface has been achieved in comparison with a similar insert of constant corner radius, and the insert has additionally been found less sensible to how the setting angle is provided compared with a corresponding insert with a straight wiper edge. Due to the above optimized shape of the chipformer in combination with the shape of said land 22 it has simultaneously been possible to increase the feed by 20-100% whilst maintaining the profile depth of the generated surface.

**0026]** In Fig. 4 it is shown how the illustrated embodiment of the insert is used for copying inwards with the insert clamped into an associated



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toolholder 17 whereby the direction of machining is designated P on the workpiece A.

**0027]** In order to achieve optimized chip control the radii of the various radial edges should lie in the following intervals:

- 0028]** 20: 5-30 mm, preferably 10-20 mm  
21: 0.2-3.2 mm, preferably 0.4-1.6 mm  
23: 0.2-1.6 mm, preferably 0.4-1.2 mm  
24: 0.6-2.4 mm, preferably 0.8-1.6 mm  
25: 1.6-30 mm, preferably 5-20 mm

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**Abstract of the Disclosure**

An indexible cutting insert includes a main cutting edge, a secondary cutting edge, and a curved corner region disposed between the main and secondary cutting edges. The corner region includes a radial edge and a corner edge, which edges are of mutually different radii of curvature. The radial edge and the secondary cutting edge are disposed on a first side of a bisector of the corner region. The corner edge and the main cutting edge are located on a second side of the bisector. A radius of curvature of the radial edge is at least five times larger than a radius of curvature of the curved edge.

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